Food & Nutrition

Research Briefs

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Inside

Nutrition and Health

Frail, elderly men and women, even those who use canes or walkers, can improve their mobility and reduce the chance of falling with a regular program of strength training. Nine residents of a nursing home, between 87 and 96 years old, volunteered to work their quadriceps—the large muscles on the front of the thigh—three times a week at 80 percent of the maximum weight they could lift. By the end of the 8-week study, the group averaged 174 percent increase in strength and 9 percent increase in muscle size. What's more, two of them stopped using their canes while another could rise from a chair without having to push off the arms. All had the typical ailments of aging people, including coronary artery disease and hypertension. But the exercise did not put extra strain on their cardiovascular systems: Blood pressure and pulse varied little during the sessions. The training has to be continuous for the benefits to last, however. The group lost a third of their muscle strength within 4 weeks after the study ended. A more comprehensive study with 100 volunteers is now in progress.

Human Nutrition Research Center on Aging at Tufts
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Older people embarking on an exercise program need to take it slow and easy. To gauge the effect of rigorous exercise on underused muscles, five sedentary men between 59 and 63 years spent 45 minutes on an exercise cycle adapted to make the front thigh muscles, or quadriceps, resist force while lengthening. This lengthening against force—which occurs in most types of exercise—is responsible for muscle damage and its accompanying soreness. Microscopic examination of muscle tissue from the men's quadriceps showed damage to nearly 50 percent of the fibers. In young men, similar exercise damaged only about 5 percent of muscle fibers. The findings are not an excuse for older people to avoid beginning an exercise program. They're just a caution to begin slowly and gradually increase the intensity as muscles get used to the new activity.

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To what extent does diet influence risk of developing colon and possibly other cancers? A new technique developed by ARS scientists to study the effects of changing dietary fat should give physicians a more solid basis for advising individuals to modify their diet long before disease develops. And it should enable scientists to survey large populations and develop a national map showing risk rates in various geographic areas. They adapted a French-developed test, which uses a genetically engineered *E. coli* bacteria to measure DNA breakage, or mutations. This is a necessary step in the transition of cells from a normal to a malignant state, so an increase in mutations increases the risk that cells will turn malignant. In the adapted test, known mutagens are extracted from human stools and applied to the bacteria, which signal the degree of mutation by the intensity of blue color produced. When 31 women in a controlled dietary study had their fat intake cut in half—from 40 to 20 percent of calories—their stool extracts produced only half as many mutations. And current studies of stool extracts from men are yielding similar results. The technique may also prove to be a good indicator of risk of breast and other cancers because fatty mutagens in the colon can be reabsorbed and deposited in the breast and other fat-containing organs.

Beltsville Human Nutrition Research Center
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Allergy to cockroaches is now being recognized as a serious threat to human health. An estimated 10 to 15 million people in the United States have allergic reactions ranging from runny nose and skin irritation to difficulty breathing and in a few cases, even death. For asthmatics with cockroach sensitivity, exposure to the insects can mean an asthma attack. An ARS expert on cockroaches is coordinating new research to counteract allergies caused by cockroaches. Working with an architect and an immunologist, the ARS entomologist is determining how home construction increases cockroach numbers and hence the amount of allergen in the air. ARS is also supplying cockroaches to doctors, who will separate the insects' proteins and test extracts on sensitive volunteers. Then, when diagnosing cockroach-sensitive patients, doctors will know exactly which of the 50 proteins actually causes allergy and can treat patients for just those sensitivities.
Insects Affecting Man and Animals Research Lab
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Children's Hospital, Dept. of Pediatrics, Little Rock, AR
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Even a marginal copper deficiency can compromise the immune system. Studies have shown that a severe deficiency of this essential trace element increased the incidence of infectious diseases in humans and animals. Now, a study with rats showed that the ability of two types of white blood cells—neutrophils and macrophages—to fight infection was dramatically impaired when the animals were fed only 50 to 60 percent of the copper recommended for their optimal growth. The findings are significant, since many Americans consume only about half the copper considered adequate. When fed a marginal-copper diet, the ability of the animals' neutrophils and marcrophages to overcome live yeasts and perform other germicidal functions decreased by 25 to 40 percent. Further, the amount of copper stored in these disease-fighting white blood cells was cut in half, as was the activity of a copper-containing enzyme. Additional studies are planned to learn whether testing of these white blood cells could be used to measure copper levels in the body. Oysters, liver, cocoa, blackstrap molasses and black pepper are rich sources of the mineral; lobster, nuts and seeds and whole wheat bran are good sources.
Vitamin and Mineral Lab, Beltsville Human Nutrition Research Center Beltsville, MD
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Copper deficiency increasingly appears to suppress the body's own antioxidants—leaving tissues more vulnerable to their own toxic byproducts and to environmental pollutants such as ozone. At least three antioxidants found in animals and humans depend on copper to function properly. In earlier studies with copper-deficient rats, adding antioxidants to their food partially protected the animals against the heart damage and anemia typical in severe deficiency. New studies done cooperatively with researchers at the V.A. Medical Center in Tucson show that copper-deficient rats exhale significantly more ethane. This suggests that more of their fats are being oxidized by toxic metabolic byproducts that copper-dependent antioxidants would normally inactivate. Finally, a study with researchers at the University of North Dakota Medical School found more lung damage in copper-deficient rats than in a control group when both were subjected to oxygen under high pressure.
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Do the nutrients we eat or neglect affect how our brains function? Answers to this question may be forthcoming from a new computer software package that makes it easier and less costly to assess the psychological consequences of dietary studies. Called the Cognition-Psychomotor Assessment System (CPAS), the software automates both the administration and scoring of more than 20 psychological tasks. These include attention, perception, learning, memory and problem-solving processes as well as sensory-motor and spatial skills. It has already helped its ARS developers find evidence that a low-boron intake slows people's reaction times in certain tasks. Designed to run on any Apple II computer, CPAS is menu-driven and can be used by novice and expert alike.
Grand Forks Human Nutrition Research Center
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Pharmaceutical companies and labs could be overlooking or misinterpreting some of the metabolic changes they see when testing new medications and compounds. While developing a rapid technique for analyzing biological fluids, ARS researchers collaborating with University of London colleagues found that metabolic products in test animals' urine can vary dramatically depending on their age or diet. This means that metabolites attributed to the compounds being tested may really be due to other factors. The new analytical technique, based on nuclear magnetic resonance (NMR), offers a number of advantages over current ones. It allows chemists to see the broad spectrum of metabolites so they don't miss products they weren't looking for. It's also more convenient and accurate. The NMR technique is not good for detecting minute amounts of compounds, however.
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University of London, London, England
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The typical American mother who nurses gets more than enough protein for herself and her baby. But new findings suggest she pays a hidden "metabolic tax." That could mean the Recommended Dietary Allowance for protein is set too low for nursing mothers. Nursing mothers retained far less protein even though they consumed 50 percent more calories than non-nursing mothers. This was surprising because calories help hold on to protein. Further studies will examine why only a fraction of the lower protein that is retained is accounted for in the milk.
Children's Nutrition Research Center, Houston, TX
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Tomorrow's Foods and Water

Adding potato starch gel to low-fat ground beef results in a tender and juicy burger. ARS scientists found that starch gel, which is used now as a thickener in salad dressings, increases cooking yields by binding the water with the meat. This is important to the fast-food industry: Burgers containing the additive actually cook faster than pure beef. The faster cooking and increased moisture retention create cooked patties with 4.5 percent less fat than cooked all-beef burgers. A trained taste panel considered these burgers to have the good-flavor characteristics of all-beef burgers. The starch-gel has been approved for use in food by the Food and Drug Administration; however, both FDA and USDA's Food Safety and Inspection Service would need to approve its specific use in meat before it can be sold for public consumption.
Meat Science Research Lab, Beltsville, MD
Bradford W. Berry, (301) 344-1994

By mixing water, non-fat dry milk, cream and other ingredients, ARS scientists have developed chocolate and vanilla shakes containing only 6 percent sugar. A typical milkshake has 10 to 12 percent sugar. This low-sugar beverage was designed as an alternative to the fluid-milk requirement of the Type A school lunch. The shake provides all the nutrients of fluid whole milk with no more sugar than that found in chocolate milk. When served from a milkshake machine, the beverage has the texture of milkshakes. A study at two high schools showed that students accepted the lower sugar shake.
Eastern Regional Research Center, Philadelphia, PA
Virginia Holsinger, (215) 233-6703

Redcrest, a new strawberry developed by ARS scientists, keeps its vivid red color even after it's sliced, frozen and thawed for gelatin or ice cream toppings. The berry's firm texture makes it ideal for jams and jellies, as well. And the green cap and hull separate easily from the ripened berry. Redcrest berries, which will grow only in the Pacific Northwest, ripen slightly later than other varieties, giving packers the bonus of a late-season harvest. The vines equal or exceed the yields of their popular counterparts. Redcrest may also be useful for breeding other varieties with improved color and texture.
National Clonal Germplasm Repository, Corvallis, OR
Francis J. Lawrence, (503) 757-4448

If global warming occurs, what will its effect be on water supplies in western states? A computer simulation of the Rio Grande basin in Colorado showed that an increase of 3 degrees C and a 25 percent loss in winter snow accumulation due to a warmer climate could result in a 30 percent decrease in total seasonal runoff. The model predicts that such climate changes could result in higher-than-normal early spring streamflow, but a greater-than-normal decrease in June and July flow. If such a decrease were to occur on many western basins, it could seriously aggravate an already existing problem of too little water. ARS hydrologists, in cooperation with University of Maryland researchers, are using the computer modeling so hydrologists can develop ways to combat these losses in streamflow.
Hydrology Lab, Beltsville, MD
Albert Rango, (301) 344-3490

Carbohydrate-sensitive consumers may soon benefit from food products made with a special type of cornstarch. It keeps insulin levels from taking drastic swings. If satisfactory products can be formulated by ARS scientists, these specialty-starch products could lead to less production and more efficient insulin use by the body. Among the products being tested are specially designed corn chips, corn muffins, bran muffins and shortbread cookies.
Beltsvill Human Nutrition Research Center
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A computer program popular for budgeting and other financial chores now helps scientists rank the most important natural aroma chemicals affecting flavor of foods such as tomatoes and nectarines. Researchers claim that aroma is the key to flavor. Thus, fruit and vegetable breeders, packers and processors could use the new ratings to ensure that their products have high-quality flavor. When linked to a gas chromatograph—a standard lab instrument that separates a flavor compound into component chemicals—the computer program speedily performs calculations scientists need to identify and measure each chemical. That's important, because even a modest sampling of the food can require thousands of individual calculations. The program meshes these results with those logged from a "sensory panel"—volunteers who sniff aroma chemicals and assess their contribution to overall flavor. The resulting list of the top dozen or so flavor chemicals in the food is a useful, thoroughly researched target for top quality.
Western Regional Research Center, Albany, CA
Donald J. Stern, (415) 559-5668

Food Freshness and Safety

An edible, inexpensive coating that can be easily applied to fresh fruit and vegetables retards ripening without reducing quality. ARS scientists added an emulsifier to a commercially available, vegetable-oil-based coating. As a result of the emulsifier, which disperses fat globules in water, the new coating increased shelf life of tomatoes, Florida-grown carambola and oranges. And scientists have successfully treated other fruits and vegetables. The coating allows produce to be stored at 70 degrees F, room temperature. Juice from coated oranges, stored for 8 to 10 days, contained up to 14 times more of the usual flavor volatiles.
Citrus and Subtropical Products Research Lab
Winter Haven, FL
Myrna O. Nisperos-Carriedo, (813) 293-4133

Apple packers can cut bruising by at least 50 percent by modifying grading and bagging equipment. Some simple changes also improved the USDA grade of apples 35 percent. Installing shag carpeting beneath the conveyor belt of a commercial grading and packing line softened the blow to falling apples. A vinyl material called Nomad, normally used as a floor matting, cut bruising when applied to equipment surfaces such as deflectors made of metal. And other improvements gave the apples a gentler drop into the packing bag. The changes were made permanent at the commercial packing line where the study was conducted. Bruise damage is a prime cause of quality and grade loss of apples headed for the fresh market.
Fruit and Vegetable Harvesting Research, East Lansing, MI
Dale E. Marshall, (517) 353-5201

Certain strains of yeast can protect apples and pears from fungal decay while in storage. Found naturally on leaves and fruit, the yeasts could become safe and effective alternatives to fungicides that control blue and gray mold and mucor rot. The yeasts work well at low temperatures and oxygen levels—the optimum conditions for long-term apple storage. ARS scientists screened more than 175 yeast and bacteria strains to pinpoint four, all in the genus *Cryptoccocus*, that give the best control. Further research seeks to understand exactly how the yeasts work, as well as practical ways to produce, store and apply the mold inhibitors on a commercial scale.
Production, Harvesting and Handling of Tree Fruits
Wenatchee, WA
Rodney G. Roberts, (509) 664-2280

Odors found in all green plants, combined with insect attractants called pheromones, make a double-whammy lure for three major insect pests. Compared to traps containing only a pheromone scent, other traps with the combination lure were at least 50 percent more attractive to the boll weevil, Mediterranean fruit fly and smaller European elm bark beetle, a carrier of Dutch elm disease. Including plant odors in lures may help growers of cotton, small fruits and other crops get a better handle on these pests. Researchers suspect the odor-pheromone blend sends a stronger message to insects' nerve cells than either substance alone. Preliminary tests also found enhanced response to similar blends by several species of moth, including codling moth and corn earworm. Further tests are planned to check new baits against Southern pine bark beetle and other insects.
Boll Weevil Research, Starkville, MS
J.C. Dickens, (601) 323-2230
Commodity Treatment, Handling and Distribution Research
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Eric B. Jang, (808) 959-9138
Plant Protection Research, Albany, CA
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The right packaging could help midwestern grape growers trying to compete in the California-dominated table grape market. Venus, Reliance and Saturn—seedless grape varieties from the Arkansas Agricultural Experiment Station—can be held at 37.4 degrees F for only 4 weeks before any apparent quality loss. Researchers found, however, that Saturn fared best after 6 weeks in cardboard boxes with shrink-wrap covers. Saturn showed the greatest potential of the three for long-distance shipment and storage without sulfur dioxide to control mold. Plastic dome-lid boxes with vent holes rated second best. Purple net bags, often used for California table grapes at retail markets to prevent loose grapes from falling, proved poor safeguards for all varieties.
South Central Agricultural Research Lab, Lane, OK
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The **Briefs** is published quarterly in January, April, July and October. For further information or addition to the mailing list, contact Judy McBride, ARS Nutrition Editor, at (301) 344-4095; or write to me at ARS Information, Bldg. 005, BARC-West, Beltsville, MD 20705.